amongst its members, and of such joint action as will further the use and success of these electrical trades. Hence its objects are not, exactly speaking, scientific, at least in the usual sense of the word, and the intermixture of genuine desire to exchange veritable experience, with a certain element of effort to push into notice particular personal "interests," renders a discriminating mind necessary in dealing with its Reports. At the time of writing, when the work of practically providing London with distributed electric current is being carried on with energy in diverse directions, and the various Electric Supply Companies are laying down mains and establishing stations, this Report serves a useful purpose of enabling us to judge the present state of the industry in the country where, of all others, it has had the most unhindered development.

In his opening address, the President, Mr. S. A. Duncan, gave some figures which are significant of the immense extent to which the electric lighting business has now progressed in the United States. The total number of arc lights in daily use is about 220,000; of incandescent lamps, some 2,500,000. There are approximately 5700 central stations and isolated plants, supplying electric current to single buildings or groups, or sections of towns. There are 53 electric railways in operation, and 44 in progress, on which 378 electric tram-cars travel over 294 miles of track. The total capital employed and sunk in these various undertakings is probably not under fifty millions sterling. When we consider that this is the growth of ten years, we are bound to admit, not only that this youngest of the applied sciences is of vigorous growth, but that its commercial basis must be sound. The Proceedings of the Convention take the form of a series of Reports on various points of interest which are drawn up by individuals or Committees, and then discussed by the whole body.

One of the important questions which in this meeting received consideration was that of underground conductors. It has been evident for a long time that arc-light wires, telephone, telegraph, fire-signal, and incandescent-lamp wires cannot be permitted to increase without limit in the form of overhead conductors. In the early days of the telephone and arc light the inconvenience of overhead wires did not present itself as a formidable one; but, with their rapid growth, the dangers to life and property arising from an indiscriminate collection of electric wires strung on poles or attached to roofs in large cities became apparent. Hence has arisen a demand that they shall be put underground.

Unfortunately this is not so easy in practice as it seems. The distributing companies in many cases desire to avoid the cost of making the exchange in those cases in which they are operating overhead wires. The expense of an underground system of conductors is from five to ten times that of aërial lines. Moreover, the various methods suggested for sub-laying the conductors in streets and roads have all peculiar merits and demerits. Mr. Edison, as is well known, places the copper conductors in steel pipes, insulating them with a bituminous compound, and lays these like gas-pipes in the streets. This system has been operated for years in New York, Milan, Boston, and Chicago, with a high degree of success. Other inventors have advocated a conduit system; others, again, the use of bare copper conductors insulated in a subway. It is thus seen that the necessary experience for satisfactorily laying down underground systems of conductors for the conveyance of large electric currents is only slowly being collected.

The city of Chicago has one of the most completely developed systems of underground conductors for arc-light wires. There are some seventy-eight miles of underground cable conveying currents under a pressure of 1000–1800 volts. The members of the Convention not unnaturally exhibited considerable differences of opinion on this question of underground conductor systems. A Committee appointed for the purpose had issued a circular to about 1066 managers of central stations and lighting systems and others, with the object of eliciting their opinions on the subject of underground conductors. Out of this number 130 returned very full answers to the various questions, and the diversity of opinion seems very great. It is difficult, however, to believe that the process of collecting information was that which would lead to the best results, and although the various views put forward in the discussion on the Report are interesting, they do not indicate a solidarity of opinion on any one point. It is perfectly certain, however, that in England electric conductors for systems of town lighting by electricity will have to be placed underground, and it is also equally certain that those responsible for this work will have to exercise the greatest discretion and take the fullest advantage of existing experience. The question of the fire risks of electric lighting also occupied the attention of the members. In the United States, as with us, the opinion based on experience is that when the work of installing the electric light is carried out under all known proper precautions, and by the best guidance, there is greater safety in it than in gas illumination, but that when these known precautions are disregarded then danger ensues. Minor questions, such as the disruptive discharges in lead cables and fuel oil, attracted briefer attention. The importance of such a gathering in guiding the experience of those who are fostering an industry like that of electric lighting, in which invention advances by leaps and bounds, is very great. We in England, thanks to the revision of the Electric Lighting Act, are now entering on a period of great electrical activity, and already it has been found that the commercial side of electrical engineering requires the association of those engaged in it for mutual advice and joint action, and the London Chamber of Commerce has now an active Electrical Section which fulfils to some extent the functions of the National Electric Light Association in America.

J. A. F.

DIANTHUS.

Enumeratio Specierum Varietatumque Generis Dianthus. Auctore F. N. Williams, F.L.S. Pp. 23. (London: West and Newman, 1889.)

ONE of the things most wanted by species-botanists at the present time is a set of monographs of a number of the familiar large genera of Polypetalous Dicotelydons. The natural orders of Polypetalæ were

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monographed by De Candolle in the "Prodromus" between 1824 and 1830, and the scattered material relating to many of the orders and genera has not since been brought together and codified. As instances of genera now involved in great confusion for want of a more recent elaboration, we may cite Ranunculus, Viola, Papaver, Alyssum, Draba, Dianthus, Geranium, Galium, and many others. The present paper is, unfortunately, not a monograph of Dianthus, but only a list of the known species classified into groups, accompanied by general remarks on the structure of the different organs in the genus, and on their range of variation, so that, though it is interesting and useful as far as it goes, it still leaves very much to be desired. Although, on the one hand, Caryophyllaceæ are dried for the herbarium very easily, and suffer little in the process, yet Dianthus is a very difficult genus for botanists to deal with and to understand. There are 230 species for a monographer to characterize. The range of variation between the extreme types is not great, and some of the commoner species (*e.g. D. Seguieri*, *plumarius*, and *Carthusianorum*) are very variable, the consequence being that, one often sees them named in gardens very incorrectly, forms of *plumarius* especially, which is hardy and spreads readily, doing duty for many totally distinct species.

Dianthus is a genus quite characteristic of temperate and sub-temperate climates. It has its head-quarters in Europe and Western Asia. There are several species at the Cape; a few are Himalayan, Chinese, and Japanese; none reach Australia, New Zealand, or the Andes; and only one just touches the extreme north-western tip of the American continent. There are two principal sub-genera: Caryophyllastrum, of which the carnation may be taken as the type, which is far the largest; and Armeriastrum, or Carthusianastrum, of which the flowers are numerous and clustered, as in the sweet-william. There is a third small sub-genus, intermediate between Tunica and the true pinks, which is classified by Bentham and Hooker with Tunica, and by Mr. Williams, following Linnæus and Koch, as a third sub-genus of Dianthus. Within the bounds of the genus, Mr. Williams finds his primary characters—those which mark groups—in the form of the calyx, the nature of the margin of the lamina of the petals, the presence or absence of a beard at the junction of the blade and claw of the petals, filaments, and styles, the shape of the leaf, and the disposition of the flowers; and his secondary characters—those which distinguish species—in the number and shape of the bracts of the epicalyx, the form of the lamina of the petals and their apposition, the character of the calyx-teeth, the form and structure of the capsule, the form and structure of the seeds, and the disposition of the fascicles of veins in the leaves of the barren shoots and flowering stems. His groups and species do not differ materially from those given in his paper in the *Journal of Botany* for 1885, p. 340. The list would have been more useful if he had stated the native country of each species, and added a reference to where it was first described. We hope, however, that he will see his way to publish, before long, the monograph of which this is a mere outline sketch.

J. G. B.

OUR BOOK SHELF.

Magnetism and Electricity. By Arthur W. Poyser, M.A. (London: Longmans, Green, and Co., 1889.)

SINCE the amount of knowledge that is supposed to constitute an elementary scientific education increases every year, there is sufficient justification for the publication of a series of science manuals designed to meet the growing requirements of the Science and Art Department examinations, and this work is an excellent representation of such a series. Apart, however, from the value of this book as an examination manual, it possesses considerable merit. The matter contained in it is just about as much as would cover the course usually taken in a year's school work; the explanatory text is couched in the clearest language, and the experiments described are capable of being easily brought to a successful termination. Also the 235 illustrations will be of considerable assistance to the student, whilst the many exercises and examination questions interspersed throughout the book may be useful tests of his knowledge. The text-books that in their day have been eminently successful, if unrevised, must be supplanted by others which take a more extended view of the subject; hence it is that this book will compare most favourably with any written for the purpose of imparting a rudimentary knowledge of magnetic and electrical phenomena and the laws by which they are governed.

The Engineer's Sketch-book. By Thomas Walter Barber. (London: E. and F. N. Spon, 1889.)

ENGINEERS and draughtsmen generally keep note-books in which are jotted down most things they wish to particularly remember, accompanied by rough sketches when necessary. The author of this book is no exception to the rule. He tells us he has made many notes and sketches during his experience as an engineer, and has often found the want of such a collection for reference. This volume consists of about 1936 sketches, classified under different headings, of devices, appliances, and contrivances of mechanical movements. The book is certainly unique in its way, and will prove useful to those who have machinery to design, who may require suggestive sketches of mechanical combinations to accomplish some desired end. The author truly remarks that a sketch properly executed is to a practical man worth a folio of description. Hence the descriptions given are generally mere names, with occasionally a concise statement of purpose. Each sketch bears a number, and on the opposite page this number is to be found with the description, &c.,—a very good arrangement.

These sketches are clearly printed, and are probably executed from scale drawings in most cases. Taken as a whole, they fairly represent what they profess to do. Sketch 1636, however, is supposed to represent a Ramsbottom safety valve, but it gives a radically wrong impression of this valve. The lever is shown resting on the two valves certainly, but the spring is attached to the lever at a point considerably above the assumed straight line joining the points resting on the valves—an impossible position. Again, one of the two points of the lever resting on the valves is usually loose and connected with the lever by a pin. The sketch shows the lever and the two projecting points made solid. This example is the most unpractical sketch discovered in the book, and should be rectified in a future edition. A fairly good index adds to the usefulness of the volume. There is ample evidence of careful work on the part of the author, and he is to be congratulated on writing a book which will probably be of use to many engineers and those connected with the profession.

N. J. L.

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